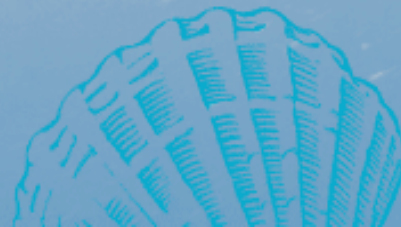
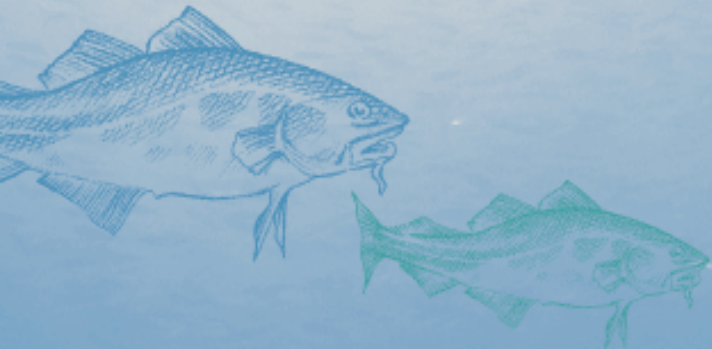


INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET






Habitat and Enhancement


Experiences and activities in Norway and Europe, based on studies of the European lobster *Homarus gammarus*

Gro I. van der Meeren, Halvor Knutsen, Jan Atle Knutsen, Ann-Lisbeth Agnalt and colleagues

**Institute of Marine Research
NORWAY**



RALBAM 4-8 January 2010

- 
- Lobster fisheries in Norway and Europe
 - Rebuilding the lobster stock

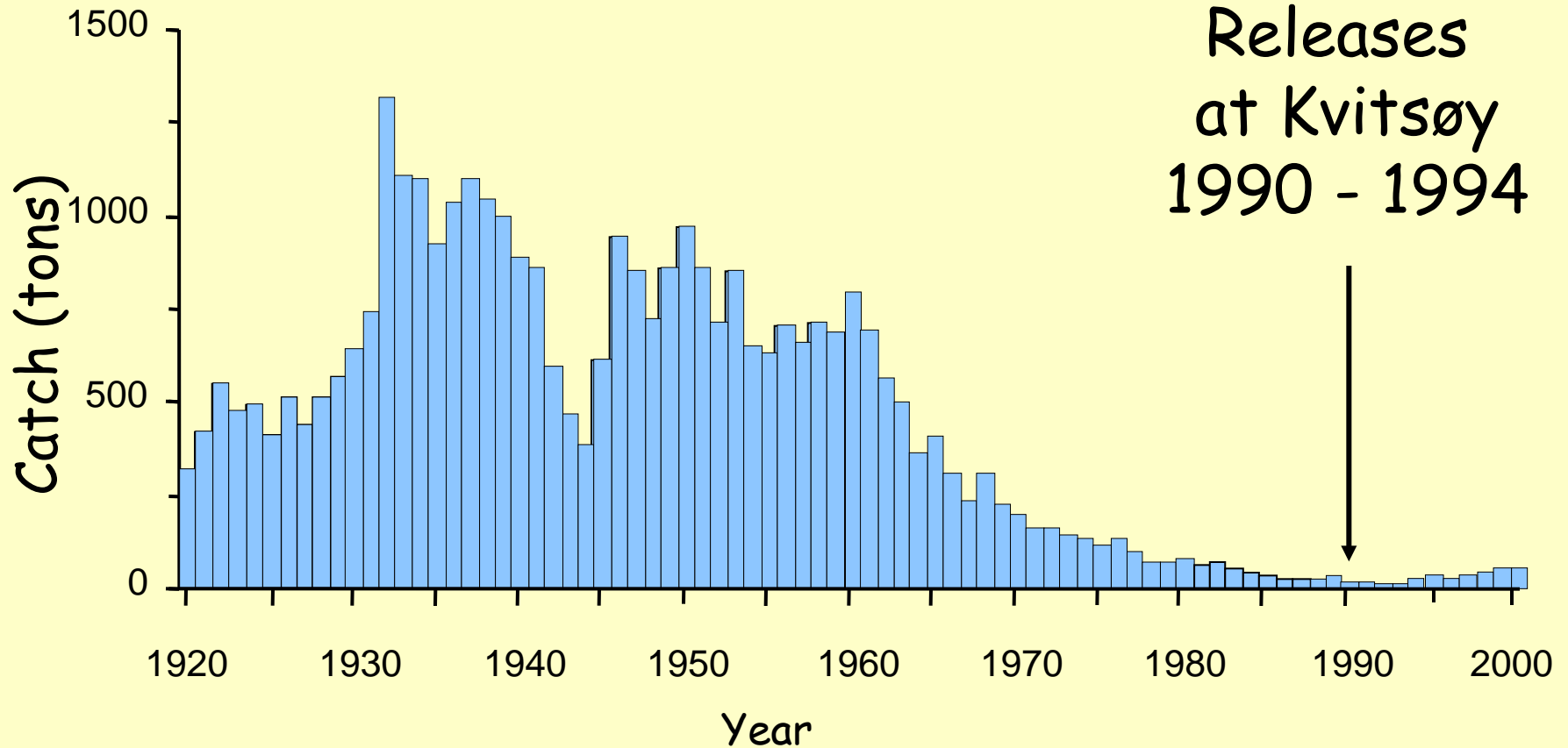
- Stock enhancement

- Release protocols
- Carrying capacity
- Habitat
- Recapture
- Life in the sea
- Juvenile quality

- Marine protected areas



Lobster fisheries in Norway and Europe



Agnalt and Jørstad, 2002




Steps in Lobster Production

Hatchery:

Larval rearing
Juvenile rearing
Ongrowth

Sea ranching:

Transportation
Release
Recapture



Juvenile rearing

Hatchery



Photo: Eva Farestveit, IMR

Individual rearing

Communal rearing

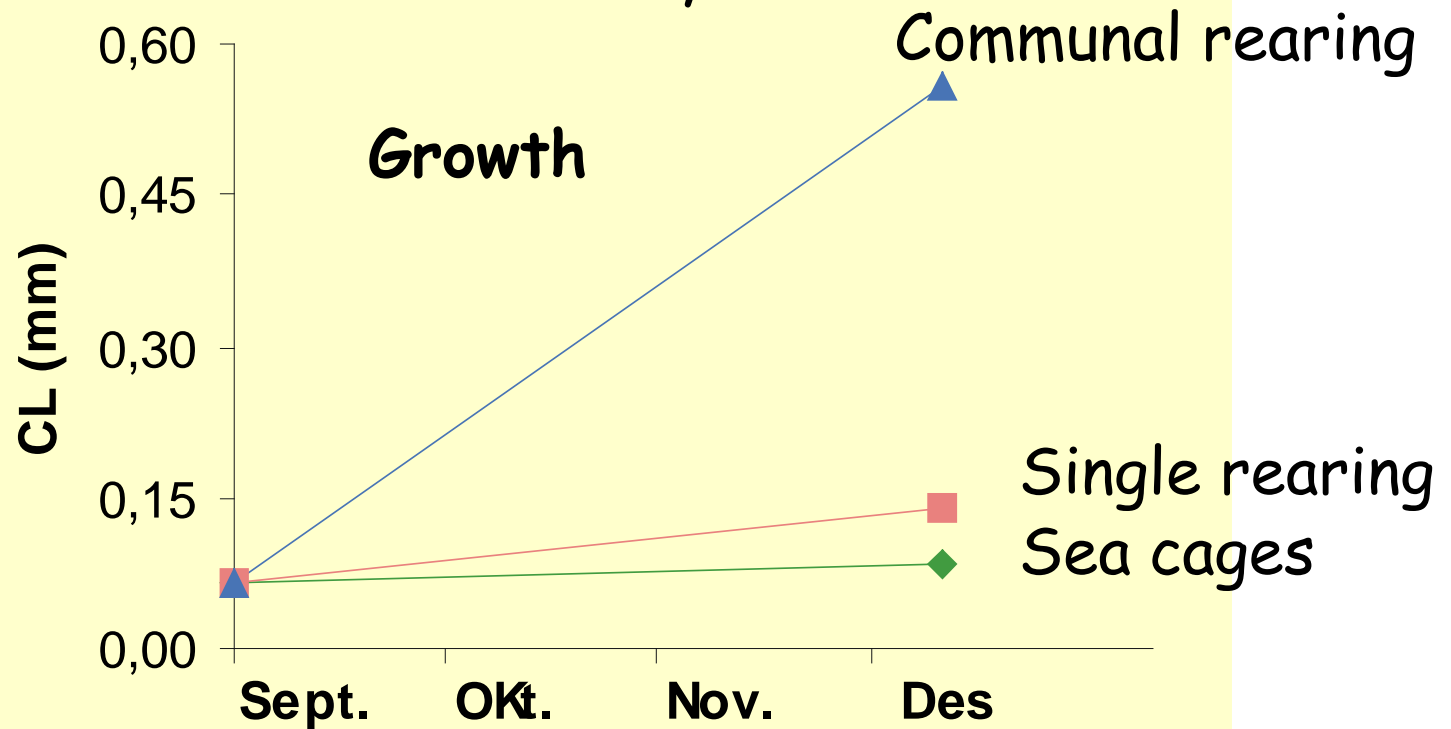


Photo: K. Jørstad, IMR



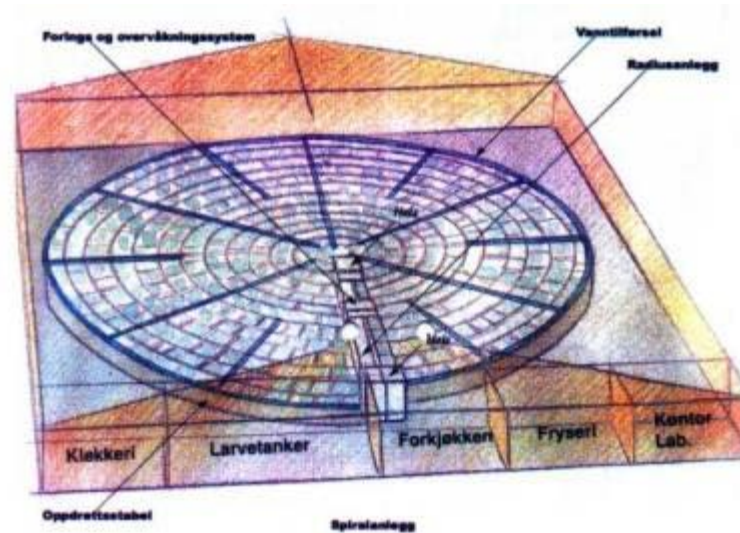
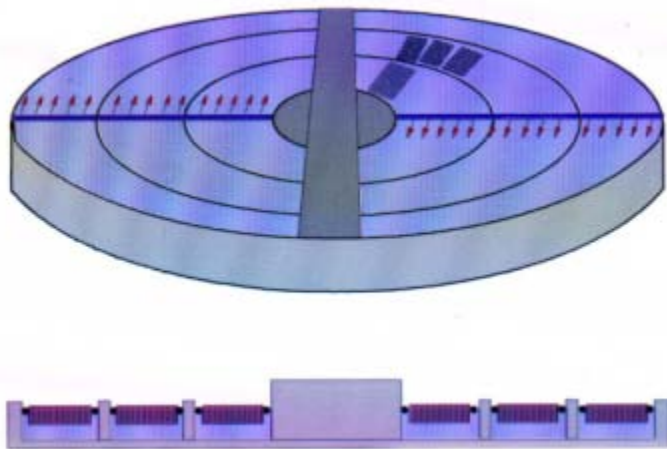
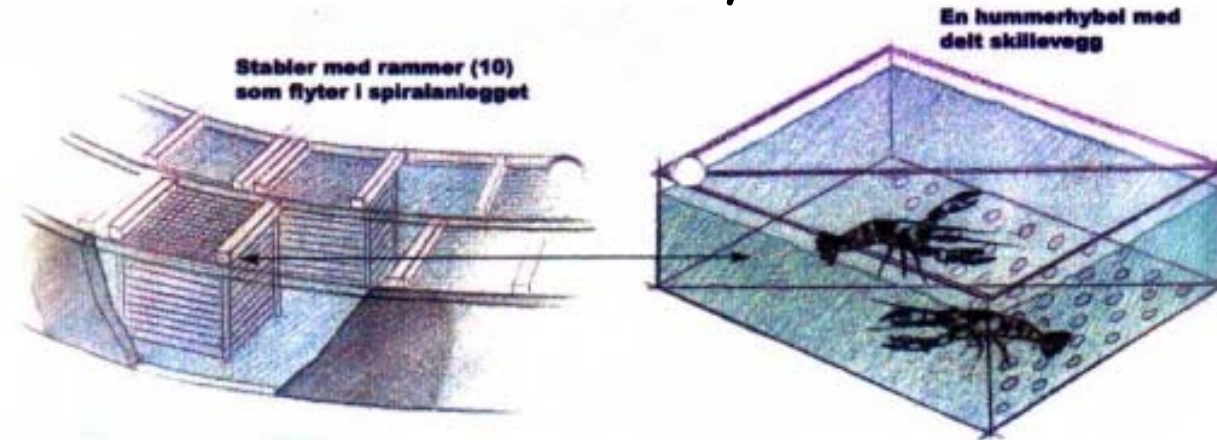
Juvenile rearing

Hatchery



Experiments by: Knut Jørstad, et al. 2001 (communal and single rearing)
G.I. van der Meeren, not published (sea cages)

Juvenile rearing Hatchery



From leaflet by Norsk Hummer A/S

Juvenile rearing

Hatchery

"Lobster house" to place in the sea

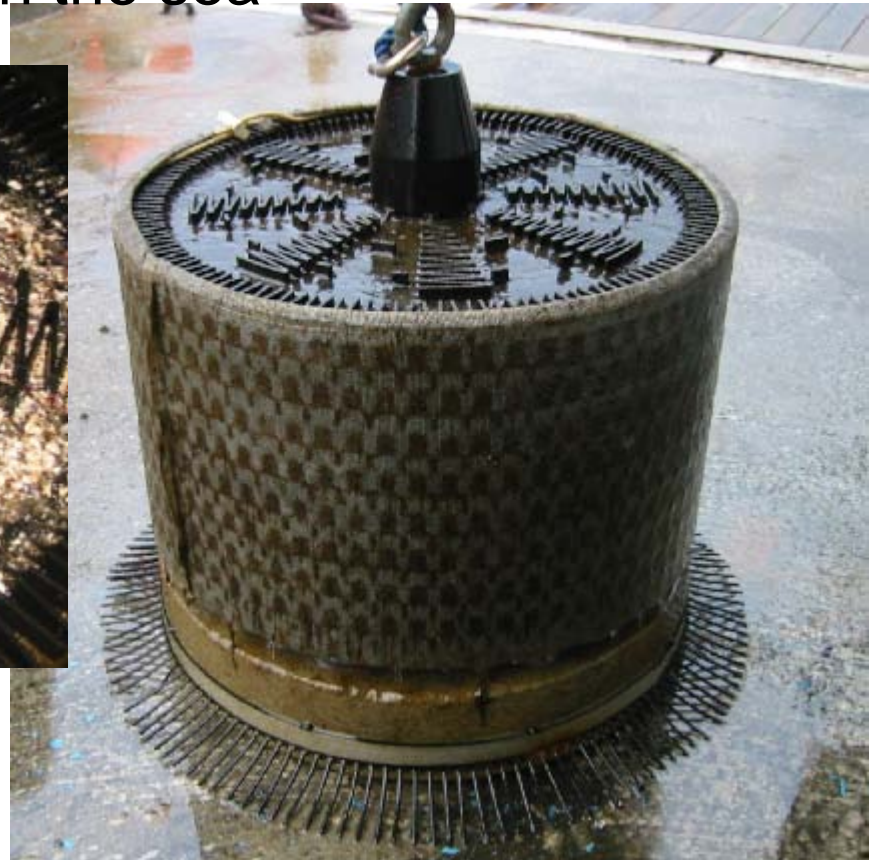
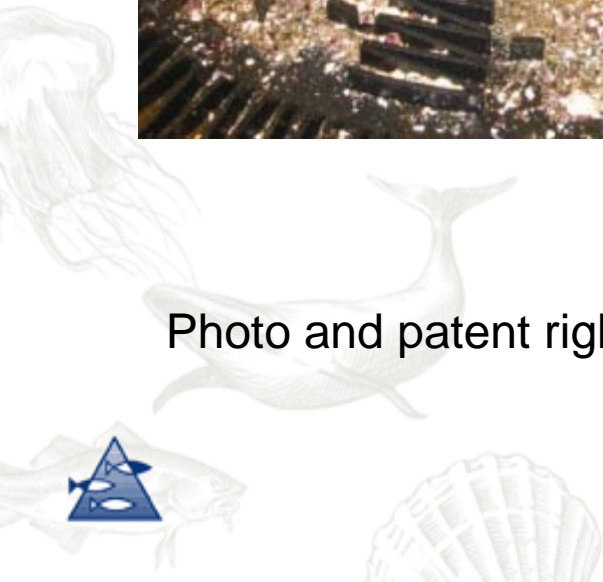
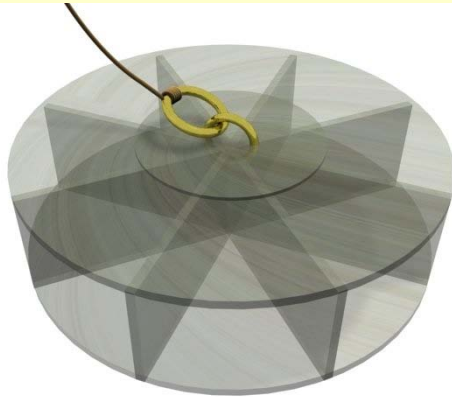


Photo and patent rights: Aegir AS



Juvenile rearing Hatchery



Construction: Andreas Gjermundsen og
Espen Eriksen, NTNU



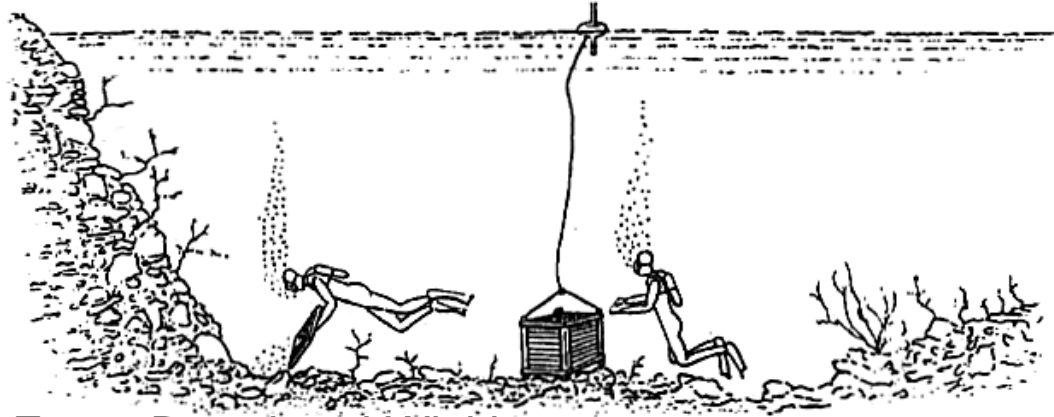
Construction: Helge Knudsen, IMR



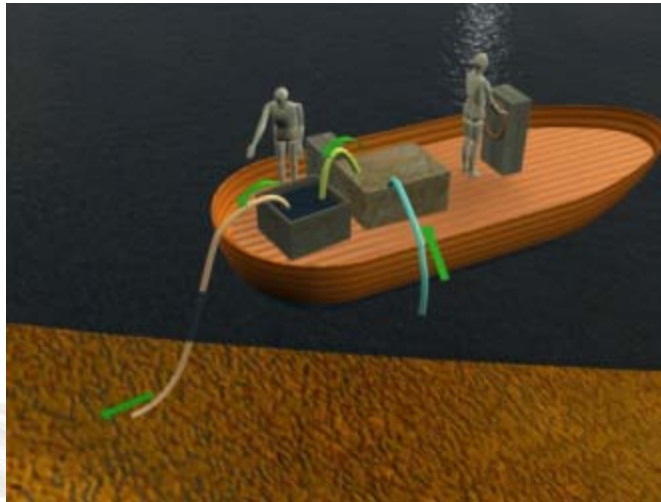


Release

Release procedures



From: Beard and Wickins 1992

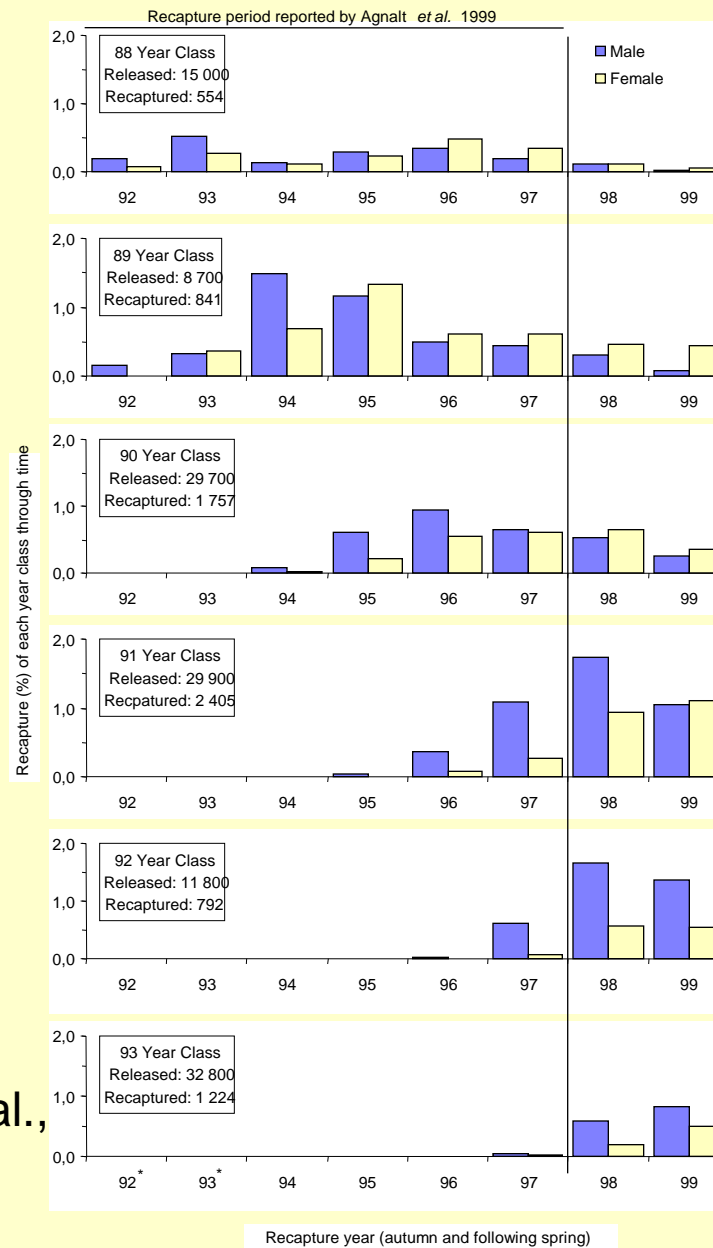


Releases in Europe, 1970-1995

Country	Region	Duration Years	Numbers released	Age at release	Recapture	%
France	Bretagne	10	225 000	2-3	?	?
Ireland	Along coast	4	292 000	2-4	?	?
France	Bretagne	5	25 480	~	22	0,09
Gr.Britt.	East England	10	49 128	~	653	1,3
Gr.Britt.	Wales	10	19 233	~	453	2,4
Gr.Britt.	W. Scotland	9	3 044	~	58	1,9
Gr.Britt.	N. Scotland	9	19 520	~	307	1,6
Norway	Kvitsøy	10	127 945	~	7 950	6,2

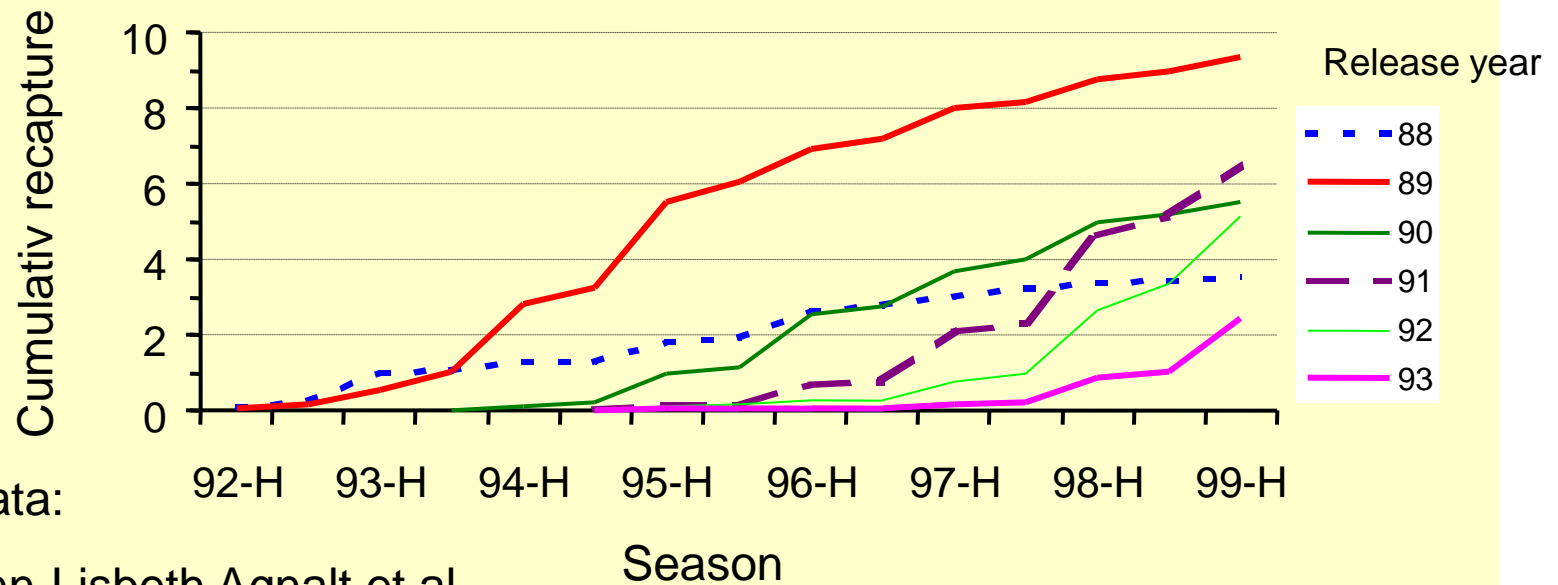
Data: Ann-Lisbeth Agnalt, IMR

Recaptures, Kvitsøy, Norway



Data:
Ann-Lisbeth Agnalt *et al.*,
IMR 2001

Recaptures of annual clutches Kvitøy, Norway



Data:

Ann-Lisbeth Agnalt et al.,

IMR 2000



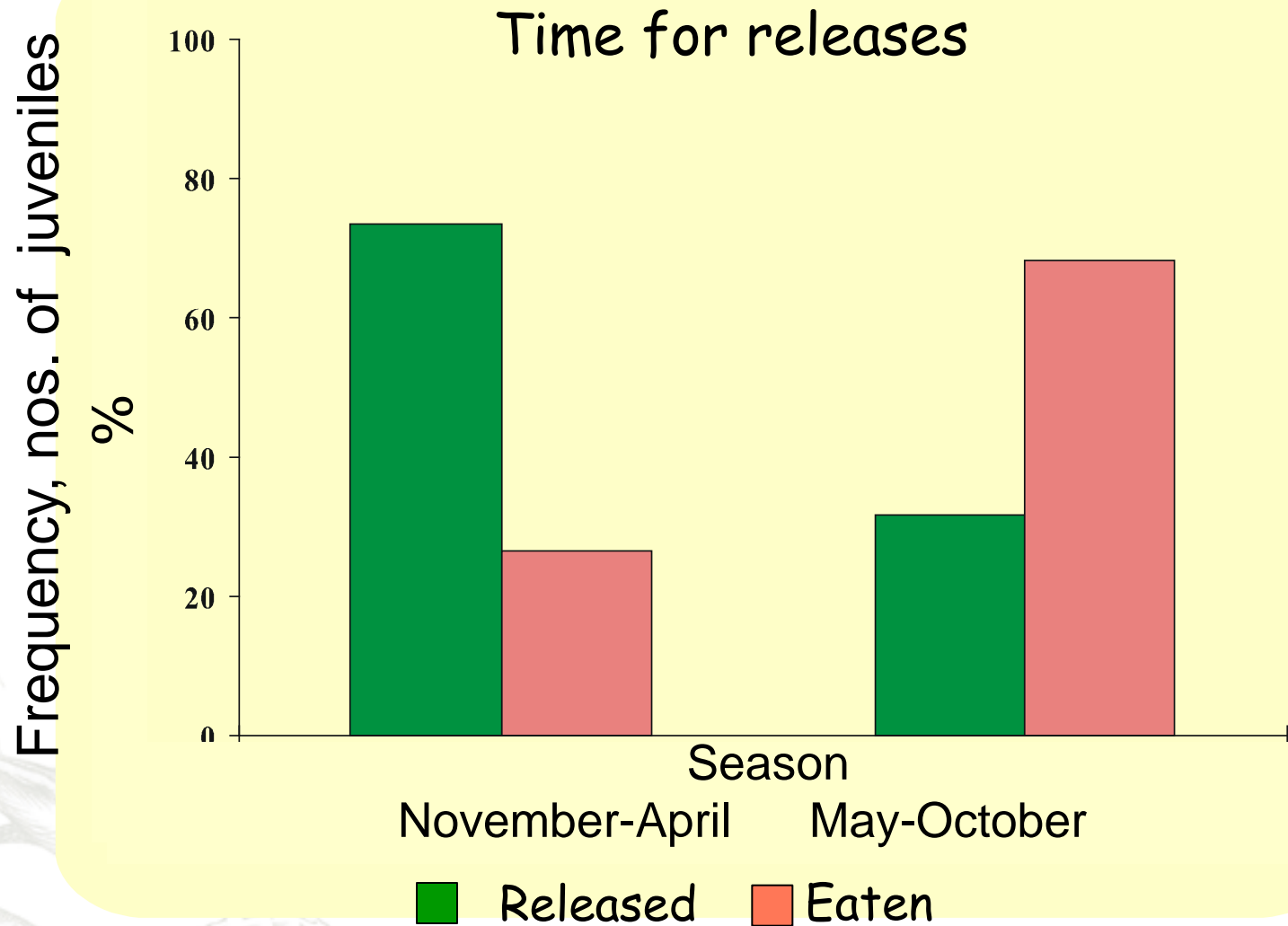
Life in the sea



From video by Eva Farestveit, IMR



Life in the sea



Life in the sea

CANO WP3 - Lobster

Aim:

Estimate carrying capacity (juvenile density) in early stages, in releases with European lobster (enhancement/ranching)

Ann-Lisbeth Agnalt, Eva Farestveit, K.E. Jørstad





Life in the sea

Artificial shelters

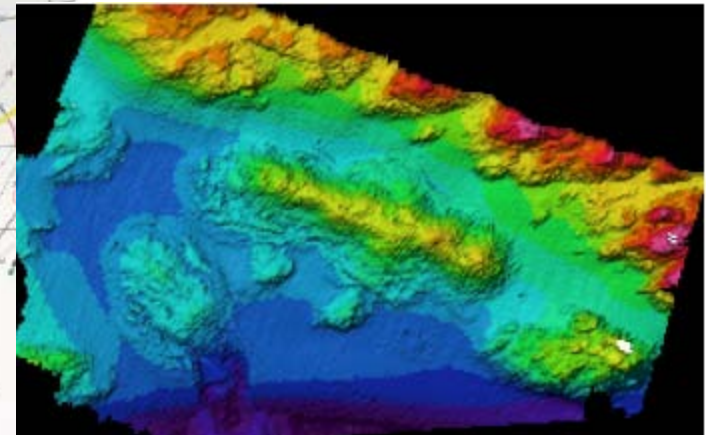
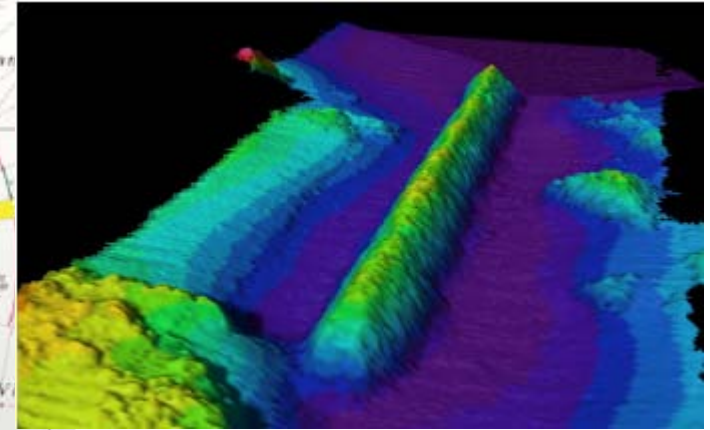
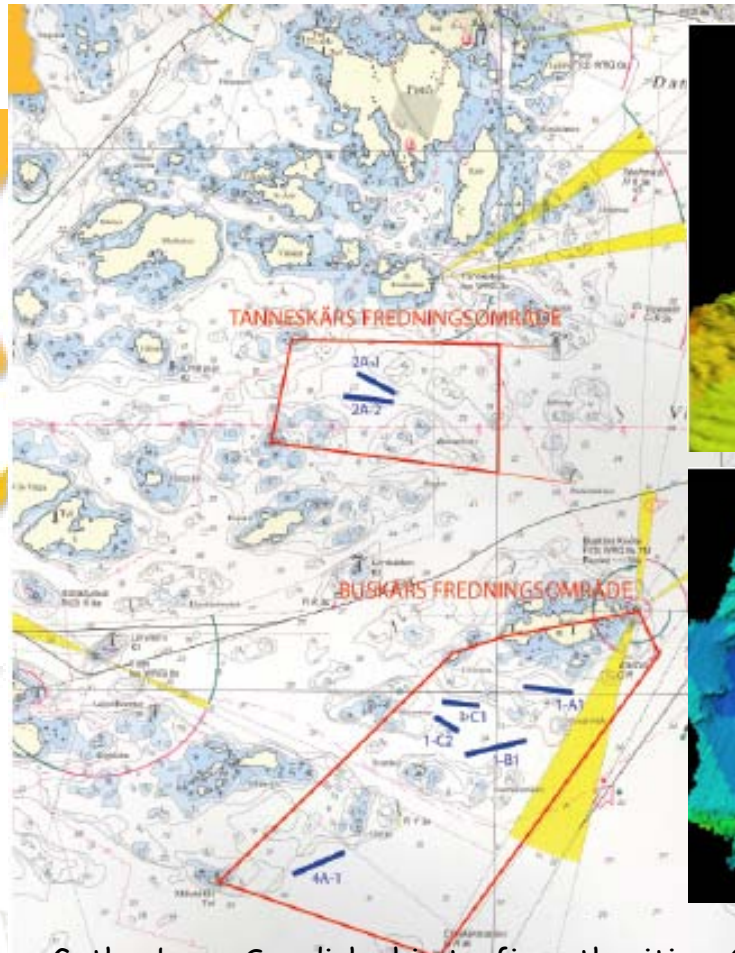


Hartvig Christie, NIVA

Life in the sea

Artificial reefs in Sweden

N. Egriell, M. Ulmestrand, J. Andersson, B. Gustafsson, T. Lundälv, C. Erlandsson, L. Jonsson, T. Ahsberg



Municipal authorities of Gothenburg, Swedish ship traffic authorities, Gothenburg University, Directorate of Fisheries EU

Life in the sea

Settling traps



Life in the sea

Bottom substrate

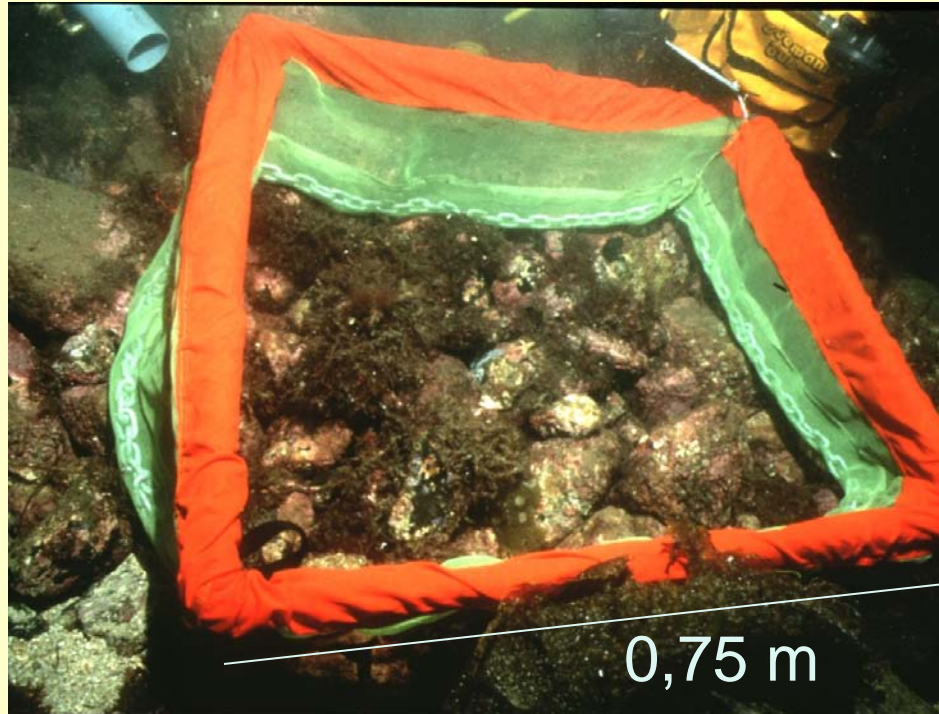
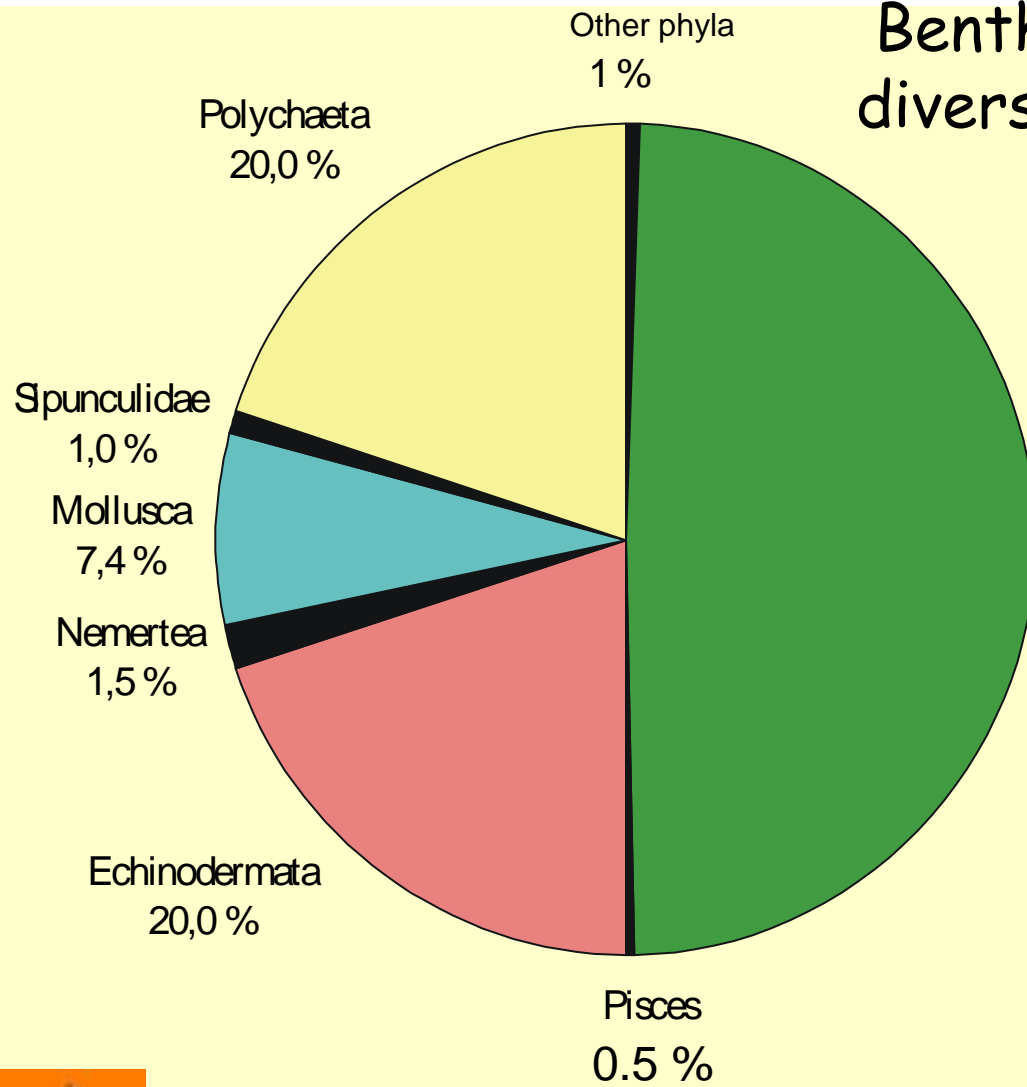


Photo: Astrid Woll, Møre Research

Linnane et al., 2001

Life in the sea

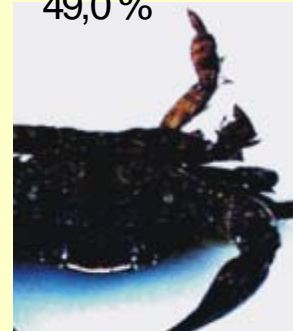
Benthic diversity



Cultivated lobster, 5th stage

Crustacea
49,0 %

Commonly found
crustaceans in
Western Norwegian
cobble grounds



Liocarcinus arcuatus

Athanas nitescens



Galathea squamifera

Pisidia longicornis



Juvenile quality

Genetics

Anatomy

Neurology

Fitness

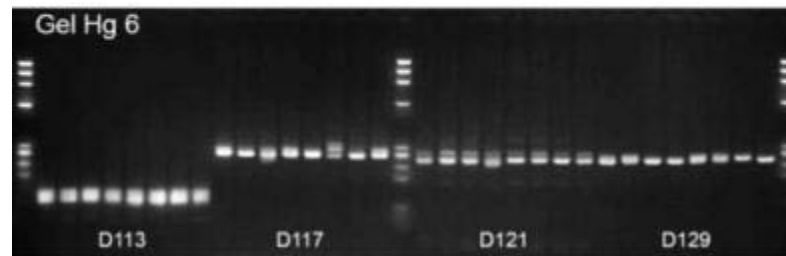
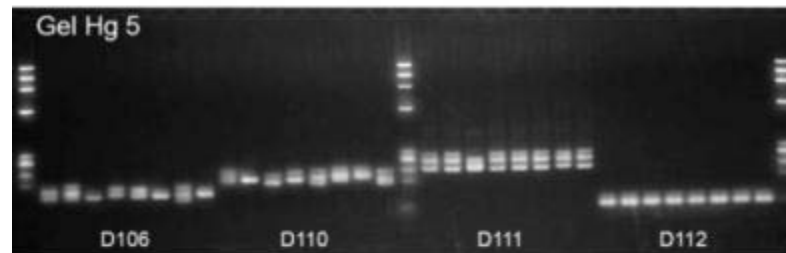
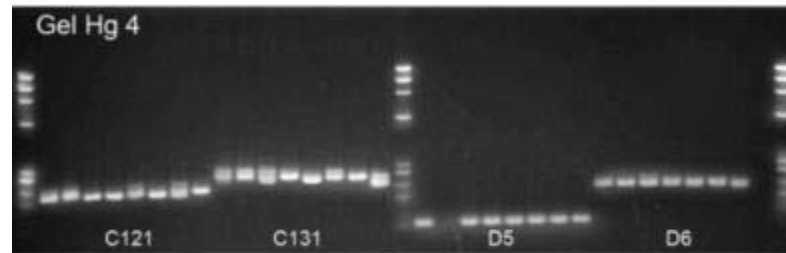
Behaviour



Juvenile quality

Genetics

Homarus gammarus primer test results, page 2



Juvenile quality

Morphology

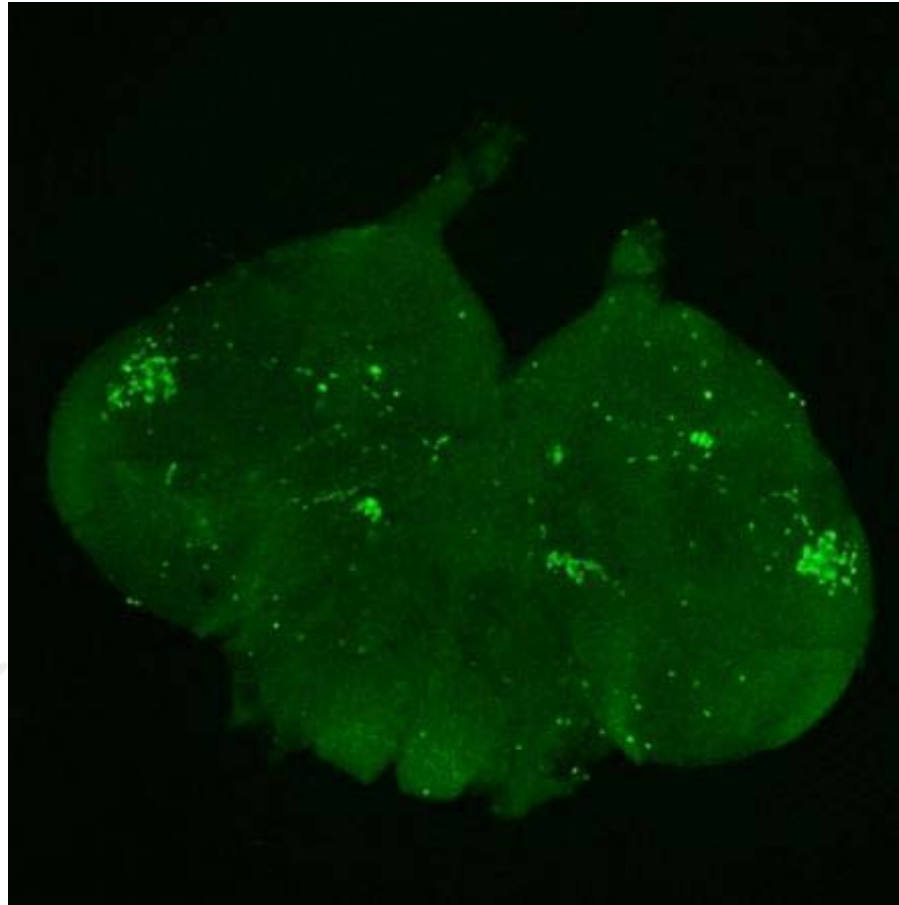


van der Meeren & Uksnøy 2000



Juvenile quality

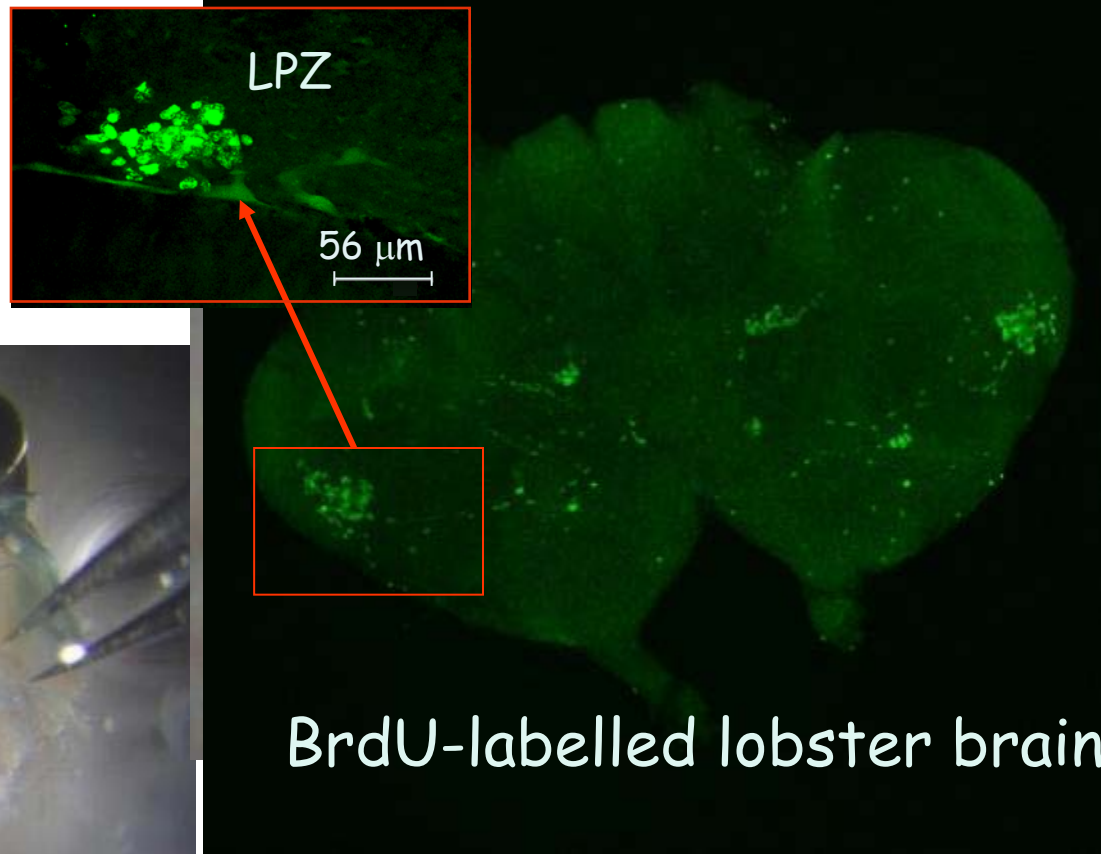
Neurology



van der Meeren et al, in prep

Juvenile quality

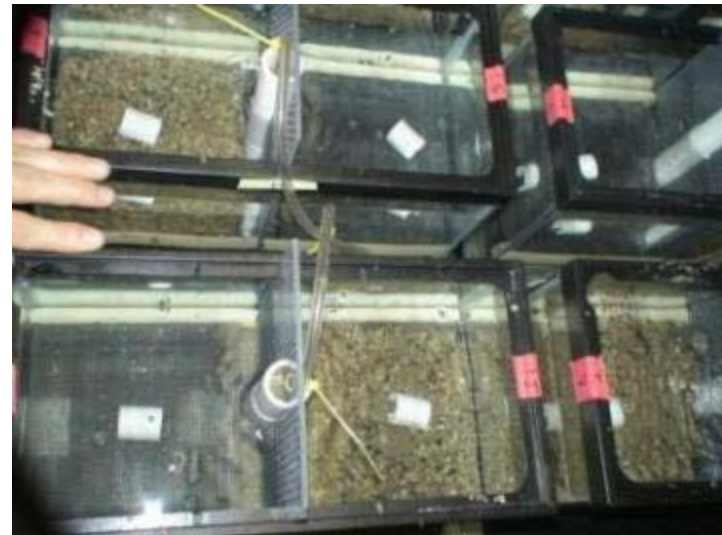
Neurology



Juvenile quality

Neurology

Neurogenesis and growth
in cultivated lobster juveniles



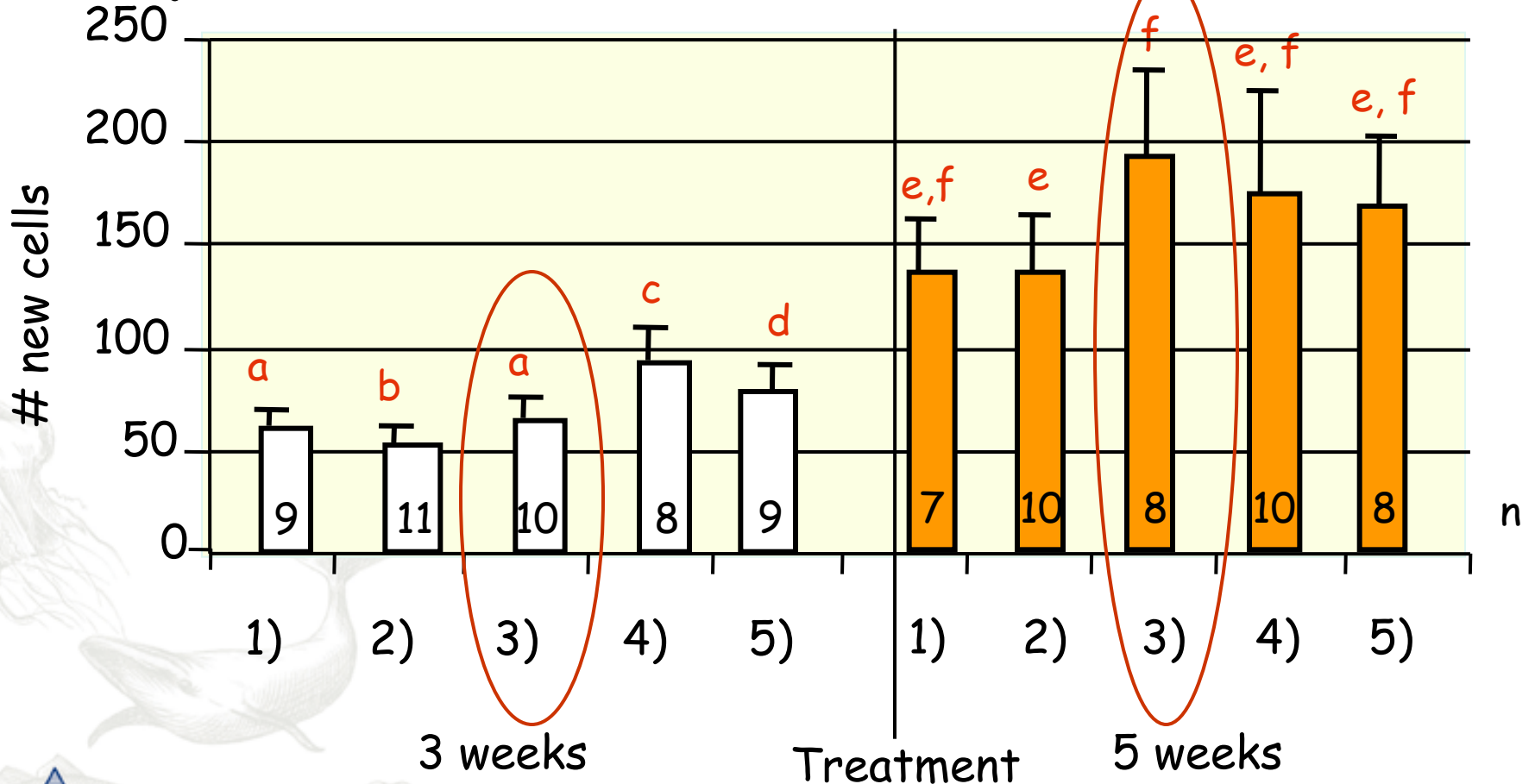
van der Meeren et al, in prep

Juvenile quality

Neurology

Established cells two weeks after
BrdU injections

- 1) Traditional compartment
- 2) Shelter added
- 3) Shelter and substrate added
- 4) Large space with shelter
- 5) Large space with shelter and substrate



Juvenile quality

Fitness



Photo: Eva Farestveit, IMR



Photo: K. Jørstad, IMR

Juvenile quality

Behaviour

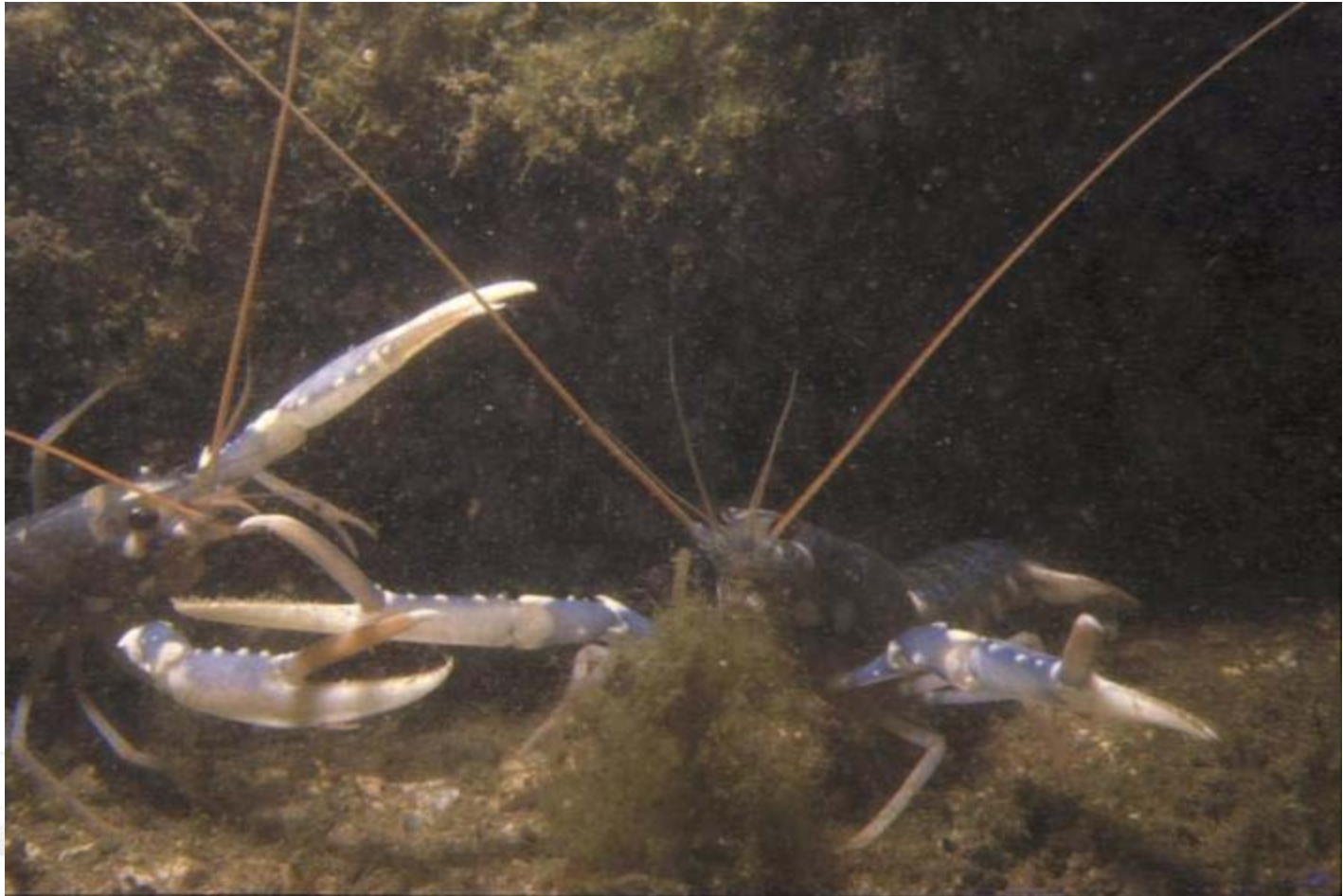
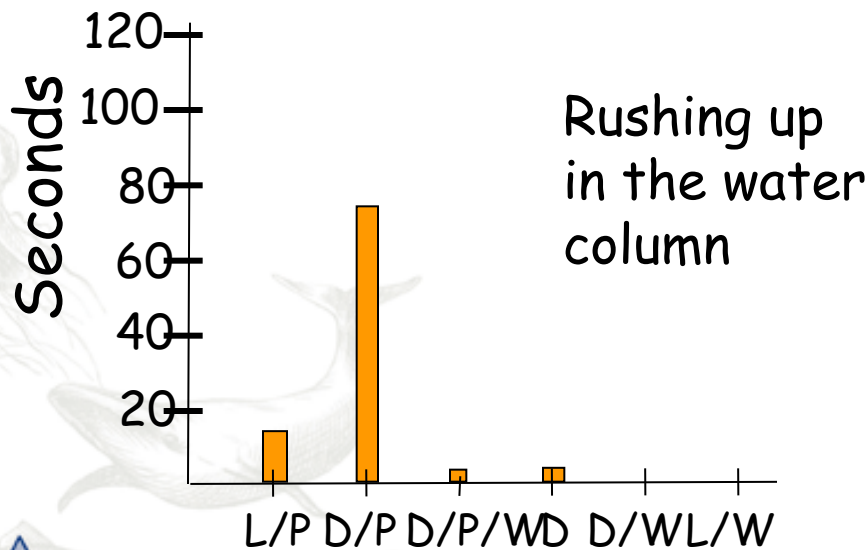
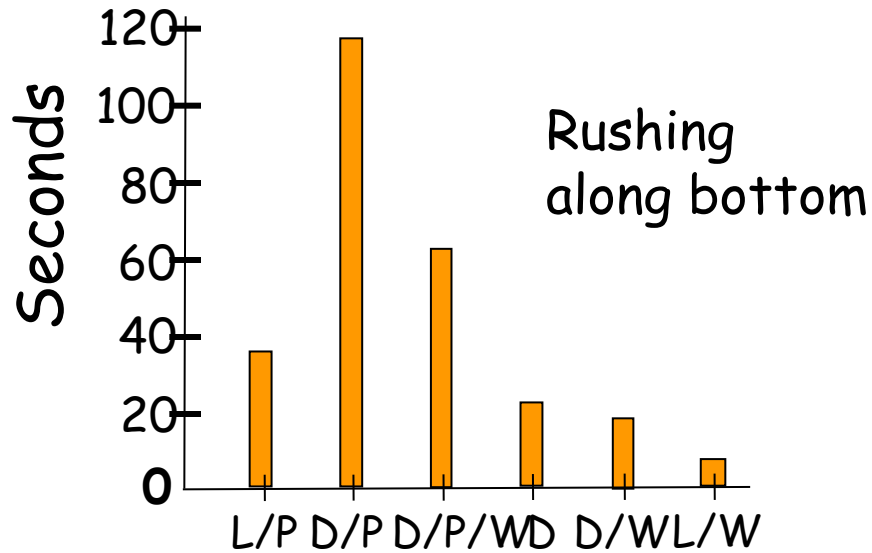


Photo: T. van der Meeren



Juvenile quality

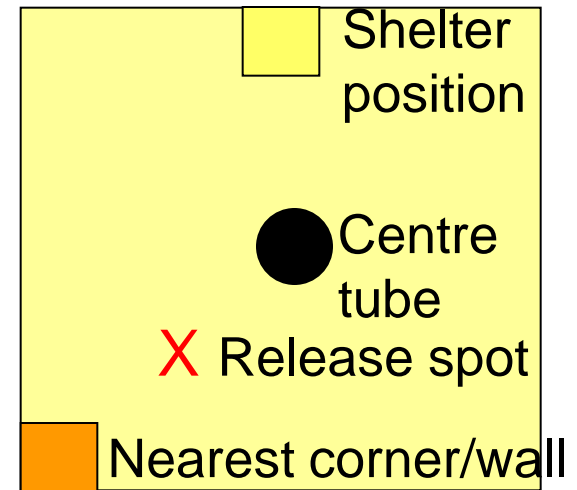
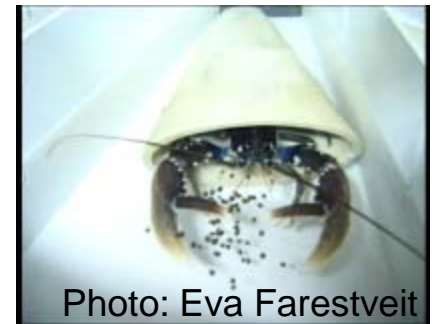
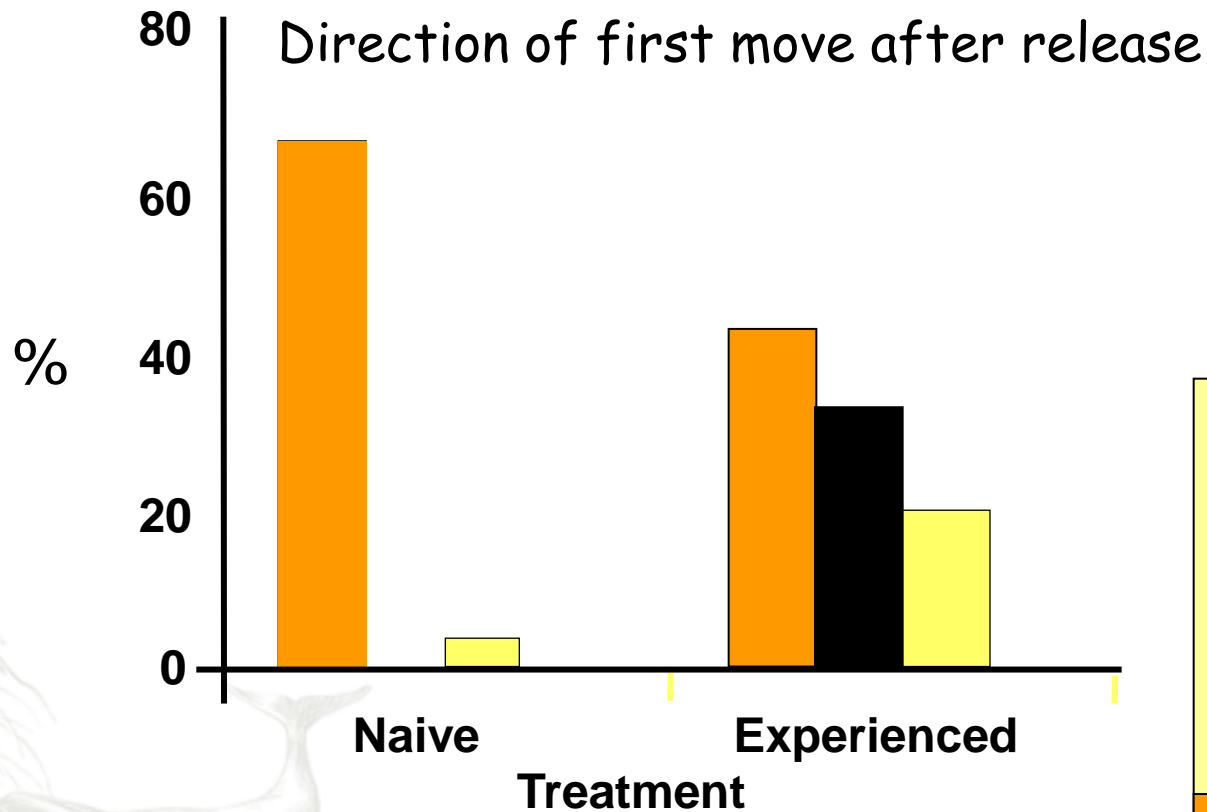
Behaviour



L = Light
D = Dark
P = under Pressure
W = in Water



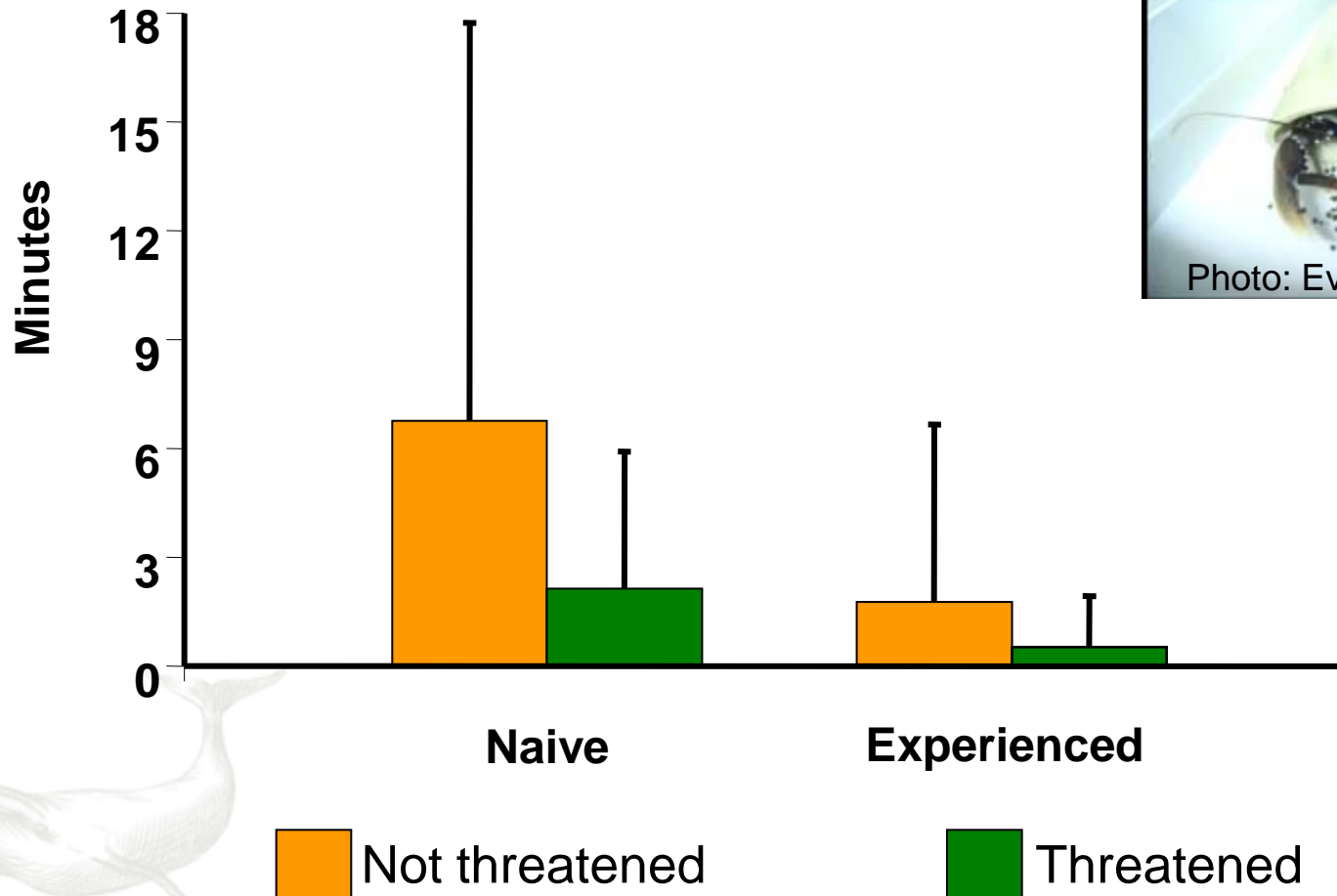
Juvenile quality Behaviour



Juvenile quality

Behaviour

Direction of first move after release



Marine Protected Areas (MPA)

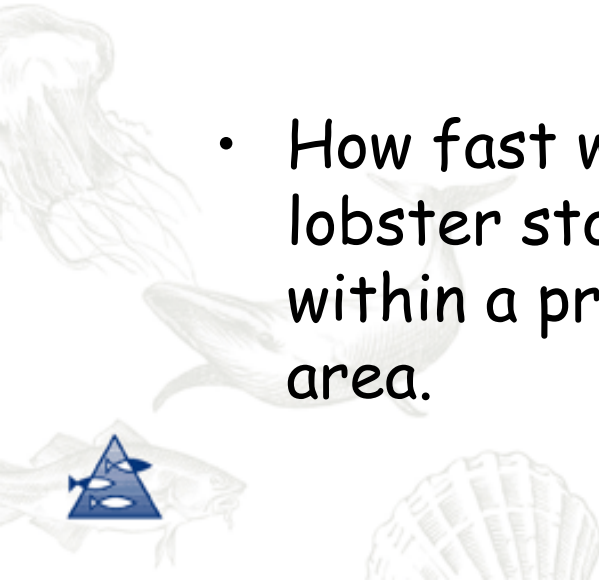
J.A. Knutsen, A.R. Pettersen, E. Moland, E. S.R. Enersen,



MPA

Establishing lobster reserves along the Coast of Skagerrak

- MPAs - of great international interest in ecosystem-based management and nature conservation.
- How fast would a lobster stocks rebuild within a protected area.

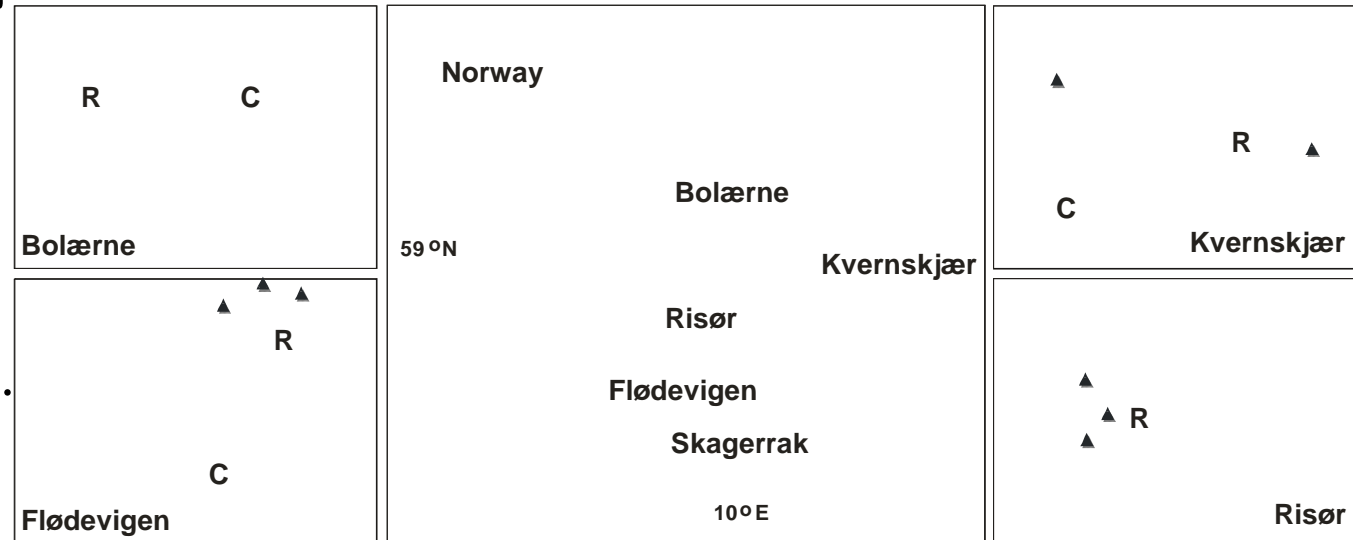


MPAs of Norway

Project started 2001.

The lobster reserves were based on information from local fishers- local management

Four lobster reserves approved 19. Sept 2006.



A monitoring programme - designed according to 'Before-After-Control-Impact-Pairs' (Russ 2002).





MPA, Interreg IIIA *"BORDER LOBSTER"*

Carl André, Jan Atle Knutsen, Halvor Knutsen, Esben Moland Olsen,
Svein Erik Enersen, Kate Enersen, Hanne Sannæs og Rune Johansen

Key questions:

- 1) How does a coastal population of European lobsters be effected by marine protected areas?
- 2) Is the population structure based on geographically isolated populations?



MPA

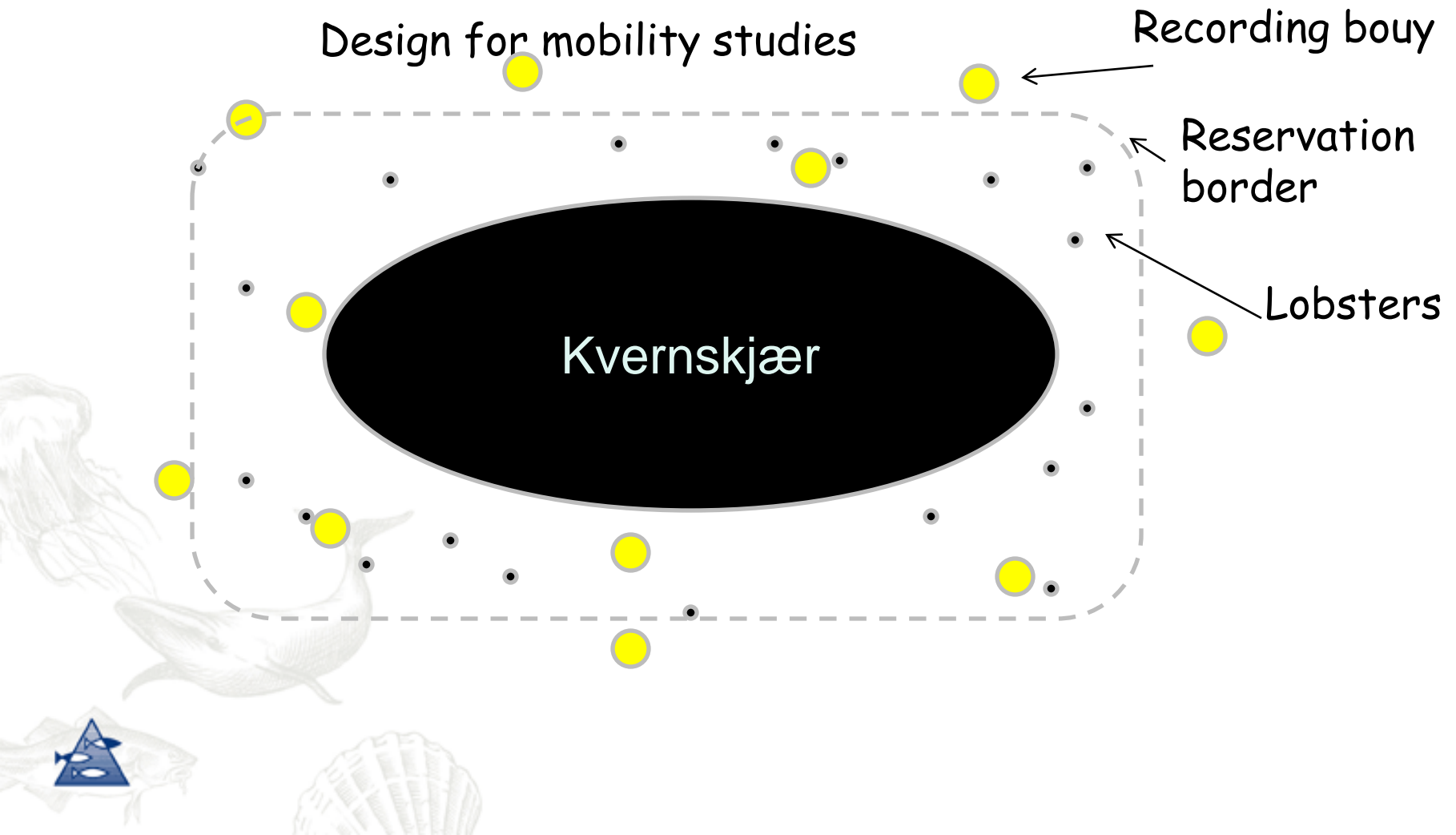
1. Effects on a coastal population of European lobsters

- Acoustic tags, to look at seasonal migration and diurnal mobility



MPA

1. Effects on a coastal population of European lobsters



MPA

Positive results

A) Mean catch-per-unit-effort inside reserve- and control areas before and after reserve establishment.

B) Mean size of lobsters (total length) caught in reserve and control areas before and after reserve establishment.

C) Egg size of egg bearing females inside-outside in reserve and control areas before and after establishment



Result presented at IMPAC II in Washington May 2009.

Under publication (contact: janak@imr.no)



Thank you!



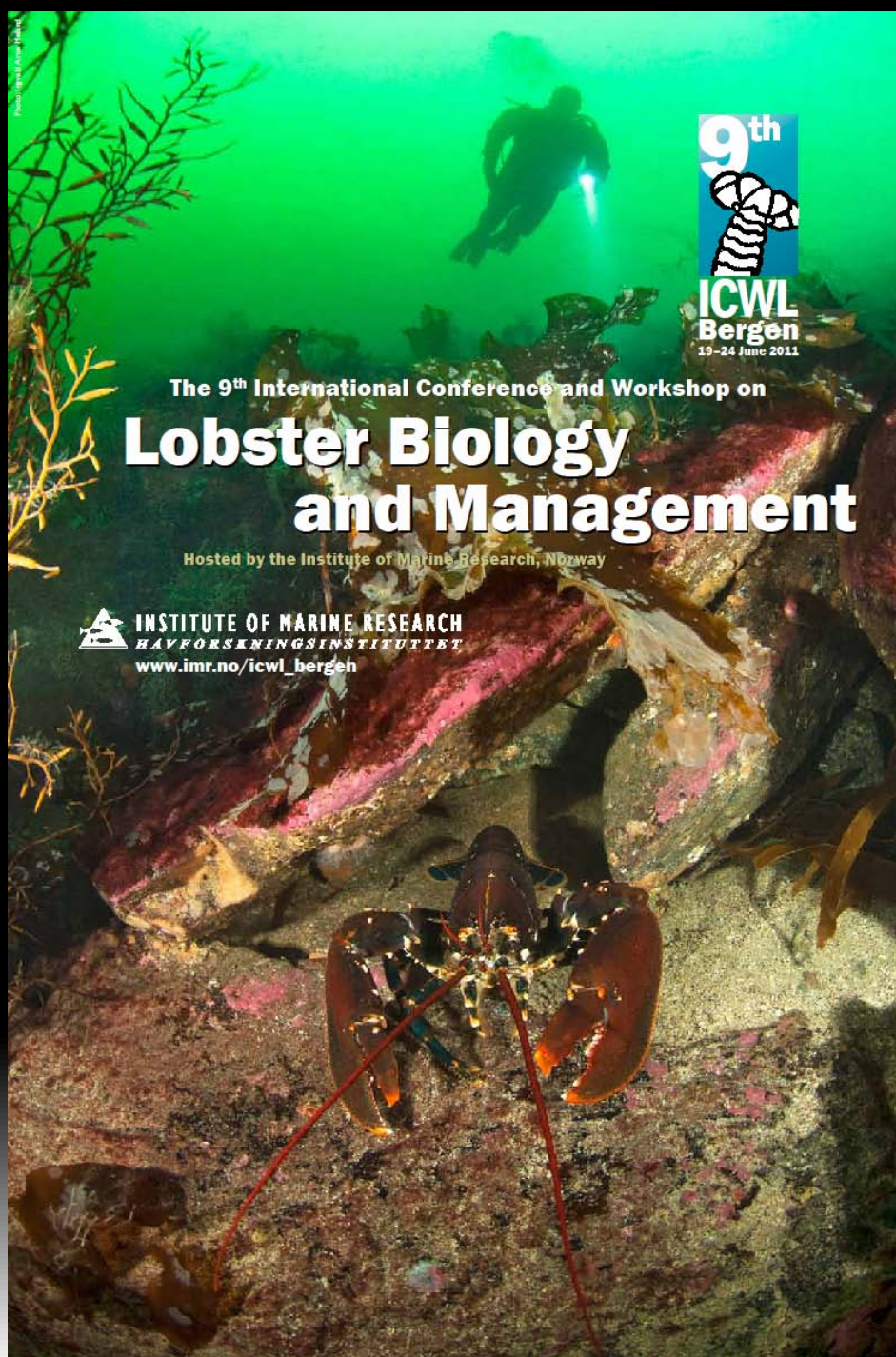


Photo: Espen Aune, IMR



The 9th International Conference and Workshop on
**Lobster Biology
and Management**

Hosted by the Institute of Marine Research, Norway

 **INSTITUTE OF MARINE RESEARCH**
HAVFORSKNINGSINSTITUTTET
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**The 9th International Conference and
Workshop on Lobster Biology and Management**



See you in 2011?

**Gro I. van der Meeren, Alf Ring Kleven, Ann-Lisbeth Agnalt,
Even Moland, Guldborg Søvik,
Halvor Knutsen, Jan Helge Knutsen, Knut Jørstad**

Institute of Marine Research, Norway

